

THE ARCTIC THROUGH 2035

AN OVERVIEW OF THE OPERATIONAL ENVIRONMENT AND COMPETITOR
STRATEGIES FOR U.S. ARMY TRAINING, DOCTRINE,
AND CAPABILITIES DEVELOPMENT



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FOREWORD

The Arctic is a national security interest for the United States. The Department of Defense's (DoD's) desired end state in the region, as expressed in the 2019 DoD Arctic Strategy, is "a secure and stable region in which U.S. national security interests are safeguarded, the U.S. homeland is defended, and nations work cooperatively to address shared challenges." This includes the objectives of defending the homeland, competing to maintain balance of power, and ensuring freedom of the global commons. DoD's strategy includes building Arctic awareness, enhancing Arctic operations, and strengthening the rules-based order in the Arctic. The U.S. Army and the U.S. Army National Guard. These Army tasks complement sister Service missions and the directed roles of global combatant commanders across all warfighting functions.

In 2016, the Army published an Army techniques publication on mountain warfare and cold-weather operations. That document emphasizes and capitalizes on the Army's recent experience at high-altitude operations. Arctic-specific operations, however, receive minimal attention.

This assessment is therefore intended to add to that body knowledge by describing the Arctic region and associated competitor activities. This information can then be used for Army training, doctrine, and capabilities development.



EXECUTIVE SUMMARY

The Arctic is a unique region of growing strategic importance. The dynamic and extreme Arctic environment and advantageous positioning of competitors will pose significant challenges for U.S. Army components to overcome to ensure land dominance and successfully complete their missions in support of the Joint Force. This report provides an overview of the Arctic as an operational environment (OE) from the present through 2035, identifies OE implications for the U.S. Army in multi-domain operations (MDO) and across warfighting functions, and discusses competitor approaches to exploiting the Arctic.

The Arctic includes all areas north of the Arctic Circle as well as western Alaska and contiguous seas of the Arctic Ocean (see figure 1 on page iv). It is one of the most inaccessible regions of Earth. It touches three geographic combatant commands and includes all time zones, with extreme cold and long seasonal periods of light and dark. Climate change is increasing the economic importance of the region by extending shipping opportunities and improving accessibility of untapped natural resources. The small and dispersed Arctic population will remain directly tied to economic resource exploitation, with the European Arctic being the most developed and interconnected subregion because its climate is comparatively milder than North American or Asian Arctic areas. As the Arctic becomes more accessible, non-Arctic countries will become increasingly interested in access to resources, but all actors will likely remain committed to working within established international legal frameworks. Consequently, a conflict over the Arctic is unlikely, but conflict in the Arctic is possible because the region represents a significant theater in a broader great-power conflict.

If a conflict does occur in the Arctic, actors will have to contend with challenges across all domains. Space support will face degraded availability and quality of satellite systems because of the unique electromagnetic environment. Cyberspace operations will have to be conducted in environments ranging from advanced, networked urban areas to remote, isolated communities with poor infrastructure. Air operations will require additional support, specialized equipment, and extra training. Seas dominate the region, but are often inaccessible. The terrestrial environment is characterized by all manner of climatological and geological extremes. The Arctic also impacts all warfighting functions. Command and control will be characterized by unreliable communications and dispersion of forces. Movement and maneuver, along with sustainment, will be slow, difficult, and require purpose-built equipment. Space and air domain challenges will degrade availability and quality of intelligence compared to operations in lower latitudes. Similarly,

fires will often be less precise because of unique position, navigation, and timing challenges. Increased vulnerabilities associated with Arctic operations will magnify protection requirements.

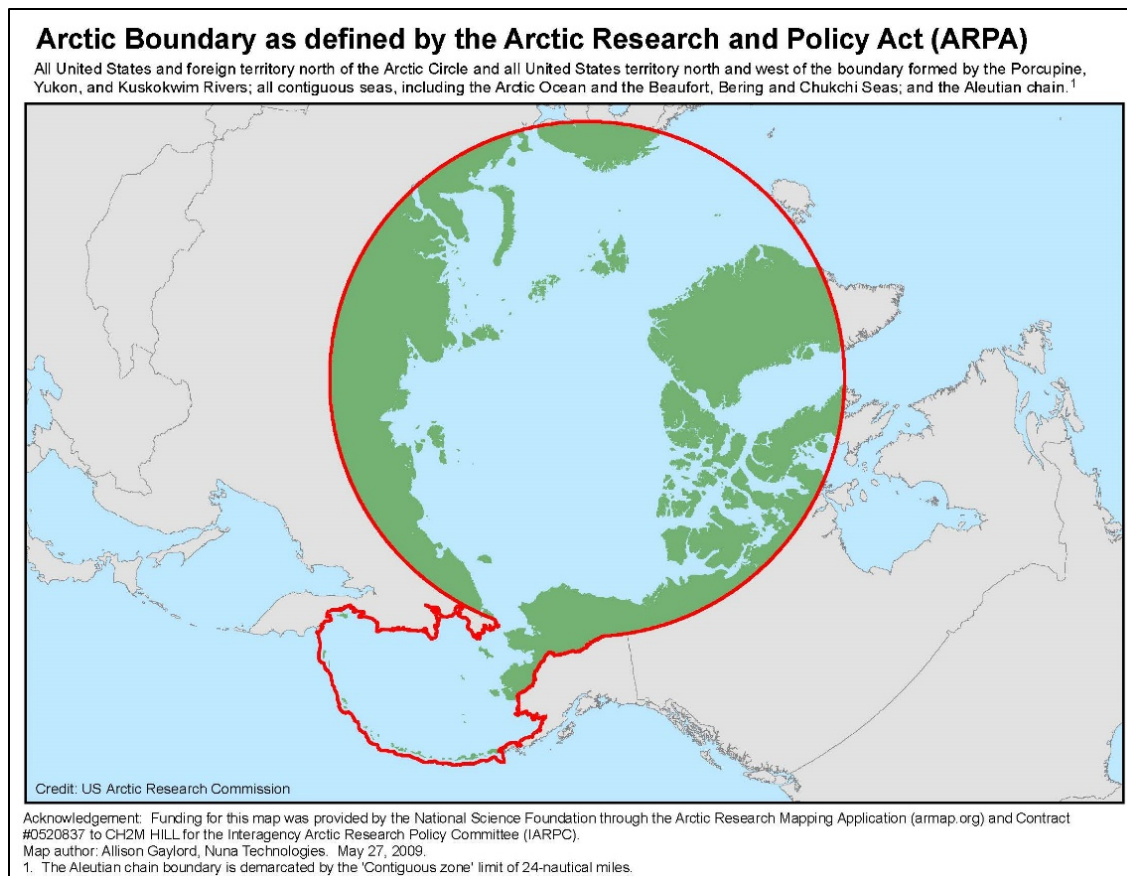


Figure 1. Arctic boundary as defined by the Arctic Research and Policy Act (ARPA).

Allison Gaylord, "Arctic Boundary as Defined by the Arctic Research and Policy Act (ARPA)," US Arctic Research Commission (May 27, 2009), <https://www.arctic.gov/maps.html>.

The two most capable U.S. competitors, Russia and China, have strategic interests and are active in the region. Russia is by far the most capable Arctic competitor, viewing the Arctic as critical to its overall national defense strategy. Consequently, the country is actively preparing its military forces to operate there, while simultaneously working to secure and exploit the region's untapped resources. Russia hopes to control enough Arctic resources, particularly energy resources, to ensure national economic stability and growth while controlling all shipping near its coastline and maintaining sufficient military power to deter any aggressors crossing the Arctic. China's Arctic ambitions and operational reach remain predominantly aspirational, but they are growing, and the country is attempting to stake claims and legitimize increasing influence in the region. China will continue to covet Arctic resources, working through economic investment and partnerships in the near future, with the long-term goal of operating in and exploiting the resources of the Arctic at a level comparable to some Arctic nations.



INTRODUCTION

The Arctic is an extreme and dynamic region. It is increasingly receiving attention from global and regional powers for its natural resources, its utility as a sea line of communications connecting Europe, North America, and Asia, and its political/military advantages. As a result, it is rapidly becoming a new theater of great-power competition. Russia has been attempting to expand its exclusive economic zones in the region and is conducting enforcement operations with internationally unrecognized authority in Arctic Seas. The Russian military has also been improving its capabilities to operate in the Arctic. Similarly, China, coveting Arctic shipping routes and potential resources, has been attempting to legitimize potential future Arctic claims by describing itself as a “near-Arctic” power.

If called upon to conduct unified land operations as a component of the Joint Force in the Arctic, U.S. Army formations will need to understand the Arctic OE. This will include competitor capabilities, capacities, and intents in the Arctic, and unique challenges the Arctic poses to multi-domain operations.

PROJECT SCOPE

This assessment informs U.S. Army doctrine writers, trainers, concepts and capabilities developers, and senior leaders about characteristics of the OE variables in the geographic space of the Arctic, including analysis of the actors that operate there. It also highlights challenges the Army will need to overcome to organize, man, train, and equip an Army capable of fighting and winning in that environment. This assessment complements previous TRADOC G2 OE assessments. It is informed by the analysis presented in the October 2019 TRADOC Pamphlet 525-92, *The Operational Environment and the Changing Character of Warfare*, which presents a general overview of what the U.S. Army can expect in the future strategic environment and notes the Arctic as a potential future sphere of competition during the era of accelerated human progress (2017-2035). It also builds on the September 2019 TRADOC paper *Competition in 2035—Anticipating Chinese Exploitation of OEs* and *Competition in 2035—Anticipating Russian Exploitation of OEs* (in draft as of July 2020), which forecast possible adversary exploitation of select OEs, including the Arctic, in the future. This paper expands upon both for the Arctic—

- It presents a forecast of the Arctic OE from the present to 2035.

- It discusses how adversaries could exploit the OE to their benefit and/or to the detriment of the U.S. and its allies.

This assessment opens with a summary of predominant definitions of the Arctic. It then provides an overview of the OE variables in the Arctic and forecasts their likely evolution through 2035, based on current trends. The assessment then summarizes challenges for multi-domain operations in the Arctic and presents likely implications of OE conditions upon warfighting functions. It provides an analysis of U.S. competitor interests, policies, and postures in the Arctic, as well as the implications thereof, which helps set the geostrategic context of the Arctic now and out to 2035.

DEFINING THE ARCTIC

The Arctic is a distinct geographic region where the OE variables interact and where the U.S. military could be called upon to operate. As one of the shortest routes between the land masses of northern Europe, Asia, and North America, the Arctic is a region with both economic and military global strategic implications. Moreover, with the reduction of polar sea ice and the resulting increased navigability of and access to this OE, along with the discovery of potential natural resources, interest in the Arctic by global competitors is increasing.

The Arctic is an extreme and dynamic region [...] that is rapidly becoming a new theater of great-power competition.

Title 15 of the U.S. Code defines the Arctic as “all United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering, and Chukchi Seas; and the Aleutian chain.”¹ The *DoD Arctic Strategy*, the *U.S. Navy Arctic Strategic Outlook*, and the *U.S. Coast Guard Arctic Strategic Outlook* also use this definition.² The Arctic Circle itself was located at 66°33’50” North (N) on 5 August 2019, and is moving a few meters northward annually because of the natural progression of the Earth’s axial tilt.³

Various international governmental, intergovernmental, and nongovernmental bodies depart from a strictly latitudinal definition, depending upon their interests, capabilities, and functions. For example, the Arctic can be defined based upon the 10° isotherm, which includes all northern hemispheric areas with a July mean temperature below 10 °C (50 °F); the presence of permafrost; or the tree line, which includes all land north of the boreal forest limit in Europe and North America.⁴ While these definitions do not align with the U.S. definition, they are important to note because they are used for international governance.

The most influential international Arctic body is the Arctic Council, of which the U.S., Russia, and all other countries with Arctic territory are members. It uses a definition that is a compromise between the various definitions and allows it to address numerous issues

germane to the organization, ranging from environmental research to international trade. This definition includes all areas north of the Arctic Circle, extended to include Asian areas north of 62 °N and North American areas north of 60 °N. It also includes Hudson Bay, seas north of the Aleutian Islands, and parts of the North Atlantic Ocean and Labrador Sea.⁵

Russia officially designates a region of its own territory as the Arctic Zone of the Russian Federation (AZRF), which contains Russian maritime and terrestrial areas above or near the Arctic Circle. These include all or parts of “the Murmansk and Arkhangelsk oblasts, the Taimyr Peninsula in Krasnoyarsk Krai, the Nenetskiy, the Yamalo-Nenetskiy and the Chukotskiy Autonomous Okrugs, as well as lands and islands ... and the internal maritime waters and territorial seas, adjacent to the northern coast of the Russian Federation.”⁶ China, on the other hand, has no formal definition of the Arctic independent of the international community.



THE INTERACTING OE VARIABLES IN THE ARCTIC

None of the OE variables in the Arctic exist in isolation. The physical environment predominates and influences all other variables and, in many ways, has a more discernable impact on the OE than it does in many other regions. It drives time and in turn is driven by time as the Earth's axial tilt, rotation, and orbit extend winter nights and summer days. The duration of solar radiation exposure, ocean currents, and the interaction of land and sea are the principle causes of Arctic climate extremes, which determine the accessibility of regional economic resources. The physical environment and location of resources shaped how communities developed, while the population centers directly influence the presence and extent of infrastructure and communications interconnectivity. Access to Arctic sea routes has historically been the most influential economic factor on international Arctic politics, although increased accessibility of natural resources is growing in importance. These political interests, combined with the physical terrain, have shaped the emplacement of military forces and conduct of military operations.

POLITICAL: ANTICIPATING INCREASED TENSION

Arctic political conditions are heavily influenced by the economic and social environments, which are themselves shaped by the physical environment. The region crosses numerous international jurisdictions, exclusive economic zones, national and international indigenous territories, and global commons. There is no single political body responsible for the entire region, although there are multiple permanent and ad hoc intergovernmental associations. Most of these organizations are dedicated to science, environmental management, and safety. Some non-Arctic countries also maintain a presence for scientific and environmental research as well as to support their Arctic partners. Additionally, the global competition between great powers manifests in the Arctic, with the primary U.S. competitor being Russia—although China is interested in increasing its presence. There are territorial disputes among various Arctic nations; these are stable at present, but could be associated with increasing tension in the future.

The most active intergovernmental associations in the Arctic are the Arctic Council, the Barents Euro-Arctic Council, and the Arctic Five. Participation in these organizations is determined by the presence of national boundaries in the Arctic region. Eight countries—Canada, Denmark (including Greenland), Finland, Iceland, Norway, Russia, Sweden, and the United States—have Arctic territory, while five countries (Canada, Denmark

[Greenland], Norway, Russia, and the U.S.) have Arctic Ocean coastline. Of note, Russia has the most expansive Arctic territory of any of these countries.⁷

The Arctic Council, consisting of the eight countries with Arctic territory, is the principal intergovernmental forum and is focused on conservation, safety, and development. By mandate, it is not a forum for security issues or territorial disputes. Six indigenous circumpolar peoples' associations are participants. Member-approved organizations or states with Arctic commercial or scientific interests may be designated as observers by the council.⁸ The Barents Euro-Arctic Council consists of the six European Arctic nations and the European Commission, and is the intergovernmental forum for the Barents region. The United States, Canada, and other states with regional interests are observers.⁹

Western European Arctic states have multi-layered international partnerships and alliances. Finland and Sweden are members of the European Union (EU). Norway and Iceland are not EU members, but participate in the EU's border-free Schengen Area.¹⁰ Denmark, Finland, Iceland, Norway, and Sweden also participate in the Nordic Council and the Nordic Council of Ministers, which are for integration and cooperation between the Nordic states.¹¹

The Arctic Five is an ad hoc association of the Arctic Ocean littoral states. It addresses emerging disputes in the region.¹² International disputes in the Arctic are associated with economic rights and maritime territory. Denmark, Norway, and Russia are asserting expanded rights to the Arctic based upon surveys of the continental shelf.¹³ Russia has claimed law enforcement authority over international waters in the Northern Sea Route (NSR), despite protests from other countries.¹⁴ China disputes Arctic nations' exclusivity to the region and has asserted itself as a "near-Arctic state" in an attempt to legitimize future claims.¹⁵ The international system has been sufficient to address disputes and grievances to date, and Arctic stakeholders remain committed to working through established diplomatic channels and international law.

The principal international disputes are associated with territorial and maritime boundaries, continental shelves, and the economic rights associated with these claims. These include disputes between the U.S. and Canada, Canada and Denmark, Canada and Russia, Norway and Denmark, and Norway and Russia—though Russia and Norway signed a maritime boundary agreement in 2010. As of 2020, all parties were working cooperatively or through international legal channels for resolution.¹⁶

FORECAST AND IMPLICATIONS: Although global strategic politics will manifest and various actors will compete for influence and interest in the Arctic, all parties appear to be committed to working within international frameworks. Consequently, the Arctic itself will likely not be a source of conflict by 2035. The Arctic Council will remain the principal international forum, although the number of observers may grow. Iceland, although its littorals are technically in the North Atlantic, may eventually join the current Arctic Five for the purpose of addressing regional disputes. Russia's continental shelf rights will eventually be accepted because of scientific merit and Russian assertiveness. Russia's

self-proclaimed NSR authorities will continue to be disputed by other countries through freedom of navigation operations. Although Russia has claimed authority to do so, it is unlikely to use force against peacefully transiting ships. If China perceives significant value and has the capability to act, it will likely stake claim to an unexploited fossil fuel reserve despite protests from Arctic Council members and observers. However, Russia will be reluctant to cede access to China and may seek to exploit the resource itself when economically feasible.



Figure 2. Arctic territorial claims as demonstrated through exclusive economic zones (EEZs).

MILITARY: COMPETING WHILE COOPERATING

The military posture of Arctic nations reflects global and regional political dynamics and is also influenced by the climate and distribution of population centers and economic resources. Military activities center on search and rescue, sovereignty claims assertion, natural resource protection, and global competition. Of these, global competition is the predominant theme and occurs primarily between Russia and North Atlantic Treaty organization (NATO) members.

Russia maintains the largest military presence in the OE. Among U.S. allies, Canada and Norway have the most robust Arctic military forces. Some non-Arctic countries, including the UK, France, and China, have intermittent Arctic military presence. Most military activity in the region is concerned with exercising sovereignty, search and rescue operations, environmental protection, or support to civilian authorities. Russia and NATO also maintain deterrent force postures in the Arctic.

NATO is the only military alliance in the Arctic. Canada, Denmark, Iceland, Norway, and the U.S. are NATO allies. Sweden and Finland are NATO partners;¹⁷ they are increasingly interoperable with NATO forces but officially remain neutral. The Arctic Security Forces Roundtable is a multinational forum to improve communications and maritime domain awareness. Canada, Denmark, Finland, France, Germany, Iceland, the Netherlands, Norway, Russia, Sweden, the UK, and the U.S. are members, but Russia, a founding member, was disinvited following the annexation of Crimea.¹⁸

RUSSIA. Russia is the only U.S. competitor with a permanent military presence in the Arctic. Russian Arctic military activity is part of a long-term strategy influenced by global rather than regional affairs, in which the Arctic is disproportionately emphasized compared to other Russian regional national security interests. Russia is actively preparing for conflict in the Arctic.¹⁹ The Russian Federation identifies three priorities for its Arctic military forces in its official strategic guidance:

- Maintaining strategic balance with nuclear forces (the preponderance of which are Arctic based),
- Employing conventional power in the Barents region, and
- Securing the NSR, particularly in the eastern littorals.²⁰

Russia's Arctic joint military capability is nested in the Arctic Operational Strategic Command, established at the Northern Fleet headquarters in Severomorsk in 2014. The Russian Aerospace Forces have an air defense division in Severomorsk and were building an Arctic air squadron with fighter-bombers as of July 2019. Ground forces include two army brigades and a naval infantry brigade, in addition to support formations. Naval forces include Russia's sole aircraft carrier and nuclear heavy cruiser, seven ballistic missile submarines, and dozens of other submarine, naval aviation, and surface assets. Arctic military infrastructure includes 14 airfields, 5 coast guard stations, and 9

military bases. Russian Arctic forces deploy worldwide and non-Arctic forces periodically deploy to the Arctic.²¹



Figure 3. Russian military bases located within the Arctic Circle

CANADA. Canada is second only to Russia in Arctic territory and interests, approaching Arctic sovereignty and territorial issues unilaterally but diplomatically. Canada also takes a bilateral cooperative approach to hemispheric security, working with the U.S. for aerospace defense. Canada has been supporting NATO missions globally, but is reluctant to involve NATO in Arctic affairs because of concerns over sovereignty and possible provocation of Russia.²² To rebuild capability to defend territory and assert sovereignty in disputed territories following extensive global deployments, Canada's

military is improving Arctic capability, with an emphasis on unconventional threats. The Canadian Armed Forces Arctic Training Centre in Resolute Bay, Nunavut is a permanent facility that is used by Canadian and allied forces for Arctic training. U.S. Army Alaska has conducted partner-force training at the center, alongside Canadian units.²³ The Canadian Arctic ground force is the Canadian Rangers, a 5,000-strong reserve force across five Canadian Ranger Patrol Groups, which can be supported by regular army mobile response. Additionally, each division in the Canadian Army maintains an Arctic Response Company Group. These groups reside in reserve units and are capable of augmenting Arctic military operations.²⁴ Canada's naval forces have limited Arctic capability but have been investing in Arctic Offshore Patrol Ships, the first of which was delivered in 2019, to support law enforcement and emergency response in the Northwest Passage (NWP). The Royal Canadian Navy also established a naval refueling facility in Nanisivik, Nunavut.²⁵ Canada is modernizing air- and ground-based maritime domain awareness platforms, employs space-based surveillance, and is investing in unmanned aircraft systems for the Arctic. Air defense prioritizes ballistic missile threats over aerial bombing.²⁶ This military approach to the Arctic highlights the significance of Canada's role in the North American Aerospace Defense Command (NORAD), through which the U.S. and Canada share responsibility for aerospace warning, aerospace control, and maritime warning for North America. It also highlights Canada's awareness of the growing importance of the Arctic and resolve to assert Canadian claims through appropriate diplomatic and legal channels.

DENMARK. Denmark's Arctic military disposition highlights its priority of civil support. Denmark's Arctic Command oversees Greenland and the Faroe Islands and is headquartered in Nuuk, Greenland. Its missions include exercise of sovereignty, search and rescue operations, marine environmental protection, and support to civilian authorities. Permanently assigned forces include personnel at Station Nord in northeastern Greenland, an air group at Kangerlussuaq in western Greenland, a home guard at Mestersvig in eastern Greenland, and a liaison unit at Thule in northwestern Greenland.²⁷ Denmark supports NATO's Arctic missions by providing basing for allies in Greenland.

ICELAND. Iceland has no military forces and little need or capability for territorial defense. NATO allies assume responsibility for Iceland's defense and periodically conduct exercises in the country.²⁸ NATO operates its integrated air defense system and aerial surveillance platforms from Icelandic territory.²⁹ Permitting allies to position and train in Iceland enables it to support NATO's Arctic missions.

NORWAY. Norway is the most proactive and robust European NATO ally in the Arctic, although its military strength is small when compared individually to Russia, which represents the country's only potential existential threat.³⁰ Norway's defense and security policy prioritizes defense against Russian Arctic activities but does not treat the Arctic as a distinct region.³¹ Norway's armed forces defend territory and sovereignty, support international allies, conduct air and maritime patrols, and support civil authorities. The operational joint headquarters is located north of the Arctic Circle, near Bodø. The army includes a combat brigade, a royal guard, and a border guard force. The preponderance

of ground forces are based north of the Arctic Circle. Additionally, a reserve force of 40,000 personnel is distributed around the country.³² In 2019, Norway reinforced its northernmost county with an additional battalion and company.³³ The navy includes small surface combatants, submarines, mine sweepers, and coast guard vessels of various types. A naval logistic station is located north of the Arctic Circle. The air force includes dozens of fighters and SAR and transport helicopters, as well as several patrol aircraft. As of 2018, the air force was modernizing its fighter capability around the F-35. The air force is primarily based in southern Norway, but has two air bases and an air defense center north of the Arctic.³⁴ Additionally, NATO's Centre of Excellence for Cold Weather Operations is located in the country.³⁵ Norway's posture and support of allies demonstrates its perception that it would be a front line in any Arctic conflict, whether small- or large-scale.

FINLAND. The missions of the Finnish military are national defense, support to civil authorities, and support to international military crisis management. Finnish military power is based upon a reserve force with universal male conscription. It includes 8,000 regular military cadre, 21,000 conscripts, and 18,000 reservists, who are trained annually. Veterans continue service in the reserves.³⁶ The army is comprised of eight brigade-size formations, one of which is stationed at or north of the Arctic Circle and specializes in Arctic warfare.³⁷ The air force has two operational fighter wings, one of which is responsible for the northern half of the country. Naval forces include patrol craft and mine warfare ships that do not normally operate in the Arctic.³⁸ Additionally, Finland has a border guard force under its Department of Interior, with two brigades located in Saami regions.³⁹ This force structure highlights Finnish neutrality, with the principal military scenario being a protracted defensive campaign with the entirety of national power working to repel an occupying external invader.

SWEDEN. The missions of the Swedish armed forces are territorial sovereignty and defense, and support to civil authorities during disaster. Its military also deploys in support of international peacekeeping, but Sweden pursues a general policy of neutrality. Forces consist of 22,000 active and 34,000 reserve personnel, drawn from a mix of volunteers and conscripts. The army has 8 maneuver battalions with 19 support battalions. The home guard includes 22,000 reservists. The air force has three JAS 39C/D fighter wings. Naval forces include surveillance vessels, small surface combatants, submarines, and minesweepers. A ranger battalion, a combined arms regiment, an artillery regiment, and a fighter wing are assigned to northern Sweden.⁴⁰ Although Swedish forces include Arctic capability, Sweden's posture emphasizes defense of the Baltic approaches.

FORECAST AND IMPLICATIONS: Russia will have the largest and most capable specialized Arctic military forces and technology through 2035. European Arctic militaries are modernizing and improving their Arctic capabilities and interoperability in response to perceived Russian aggressiveness in areas such as Ukraine and Georgia. As long as European countries perceive Russia as aggressive, this can be expected to continue. However, European responses are unlikely to match—let alone achieve overmatch with—Russian forces in the region, as Russian investment in Arctic military capability outpaces all others. Although there are no indications the current framework of alliances and

partnerships will change structurally, international military cooperation will likely continue to increase. Russia's military activity will continue to grow, with Arctic forces prioritizing maintenance of credible deterrence through Barents Sea area-based nuclear forces, defense of the Kola Peninsula and the Barents Sea region, and protection of increased Arctic economic activity. Russian forces already are increasing their presence and military infrastructure to ensure security of the NSR, and will likely continue to expand this presence as international shipping activity—and therefore revenue for Russia—continue to grow.

ECONOMIC: A REGION OF GROWING IMPORTANCE

The Arctic economy is small compared to other regions of the world, because of low population and historic inaccessibility caused by the extremes of the physical environment. The principal economic activity is natural resource exploitation, and the Arctic Five nations have asserted the right to regulate economic activity even in international waters. The region has abundant untapped mineral wealth, including gold, lead, silver, zinc, copper, iron, nickel, diamonds, rare earth metals, and uranium, among others.⁴¹ Arctic fossil fuel resources include an estimated 90 billion barrels of undiscovered oil, 1,669 trillion cubic feet of undiscovered natural gas, and 44 billion barrels of undiscovered liquid natural gas, which account for 30 percent of the world's undiscovered natural gas and 13 percent of the world's undiscovered oil.⁴² Arctic marine fisheries are small compared to other regions of the world, and the Arctic Five have banned central Arctic fishing for several years, pending ecological impact assessment.⁴³

The Arctic has been warming faster than any region on Earth and, in the short term, climate change is increasing the importance of the Arctic economy and of the Arctic itself to the world economy.⁴⁴ Climate change contributes to northward expansion of boreal forests, which provide energy sources and support rural economies.⁴⁵ Climate change is also associated with improved stocks of Arctic fisheries. The long-term effects of this shift may be deleterious, because stock increase is associated with northward fish migrations and insufficient information exists about preexisting polar stocks that historically support



Figure 4. Illustration of the disparity in total number of icebreaker ships operated by members and observers of the Arctic Council

mainly subsistence activities by indigenous communities.⁴⁶ Although the Arctic will remain a challenging environment for the foreseeable future, decreases in annual sea ice, along with advances in extraction technology, are making Arctic fossil fuel basins more accessible and potentially more lucrative.⁴⁷ Decreased sea ice is also opening up tourist markets, as cruise ships began navigating the NWP in 2016.⁴⁸ Finally, decreasing sea ice is extending opportunities for global shipping, in turn increasing the geostrategic importance of the region. Russia has been capitalizing upon this opportunity by investing in an icebreaker fleet that vastly outnumbers those of all other Arctic nations combined.⁴⁹ Although the Arctic will not surpass warmer shipping routes in traffic volume, there is a growing number of ships transiting between Asia and Europe via the NWP and the NSR, the latter being the most robust northern shipping route.⁵⁰ Finally, increased accessibility due to climate change is prompting non-Arctic nations to assert themselves in the region. China has the largest embassy in Iceland, a large presence in Greenland, and has maintained a permanent scientific presence in Norway since 1925. In addition, China, Japan, and South Korea have developed ice-breaking capabilities to enable Arctic transport, research, and resource exploitation.⁵¹

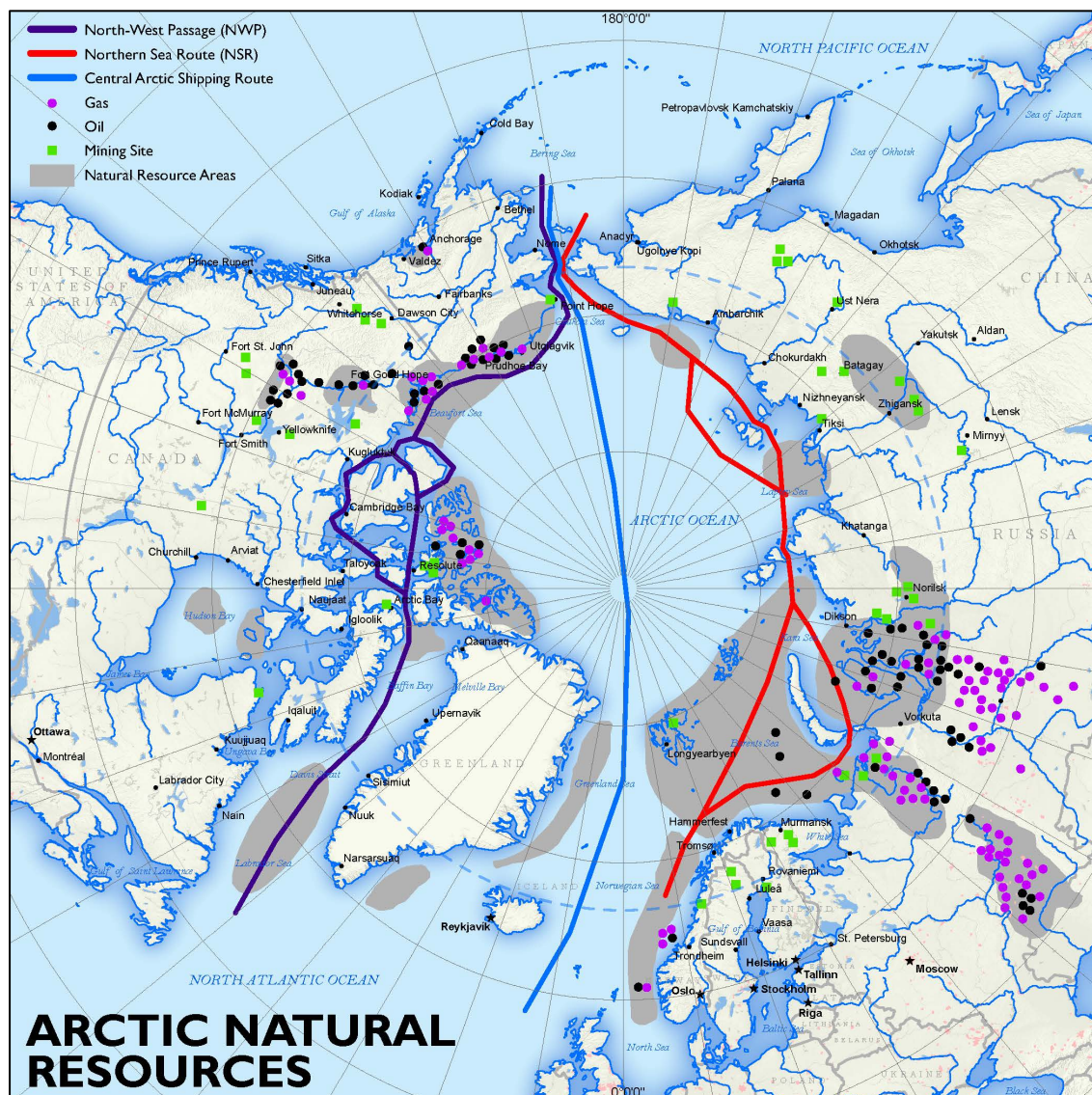


Figure 5. Locations of shipping routes and Arctic natural resources

FORECAST AND IMPLICATIONS: The seasonal Arctic shipping lanes will not replace year-round traditional southern routes by 2035, but will become more lucrative as sea ice retreats and seasons lengthen. This will in turn drive geopolitical interest in accessing the region as an optional, shorter route between the Pacific and Atlantic Oceans. The NSR will continue to see more traffic than the NWP, because of Russia's legacy capability and historic usage. Russian domestic shipping will remain the primary maritime activity along the NSR. Chinese energy and container traffic will constitute the primary international customer in the NSR. The Arctic economy will grow in proportion to decreases in annual sea ice, which will in turn extend shipping seasons and ease access to natural resources. As the Arctic becomes more accessible, non-Arctic countries will become increasingly assertive about access rights to Arctic fossil fuel resources in international Arctic waters. Large-scale exploitation will not occur for many years because low global prices will not

yield sufficient profitability to justify the expenses associated with environmental extremes. Arctic fisheries will remain untapped, although actors are preparing to stake claims.

SOCIAL: DISPERSED, ISOLATED, AND THREATENED BY PROGRESS

As a consequence of environmental extremes, the Arctic population is small, dispersed, and isolated compared to the populations of other geographic regions.⁵² Populations cluster in comparatively milder European Arctic areas and around economic resources, which have historically been associated with subsistence but increasingly involve mineral and energy reserves. The global population above the Arctic Circle includes approximately four million people, half of which reside in Russia.⁵³ Arctic communities are predominately coastal and generally characterized by densely populated areas separated by long distances. Following an era of decline in the late 20th century, the overall Arctic population has stabilized, with general decreases in Russia and increases in Western Hemispheric countries, attributed to natural resource exploitation. Populations are becoming increasingly urbanized in all Arctic areas.⁵⁴ As of 2019, seven Arctic urban areas had populations greater than 50,000 people. Five were in Russia: Murmansk (292,465), Norilsk (180,976), Vorkuta (54,223), Apatity (55,201), and Severomorsk (52,597). Two were in Norway: Tromsø (76,649) and Bodø (52,024).⁵⁵ Russia had the largest Arctic population but Norway had the largest percentage (10 percent) of its population north of the Arctic Circle.⁵⁶

Indigenous circumpolar peoples include approximately forty distinct ethnic and linguistic groups that constitute approximately 10 percent of the total Arctic population. Several groups span across international boundaries. Six are officially recognized by the Arctic Council, which gives them an international platform. Major groups include the Saami in northern Finland, Sweden, Norway, and Russia, and the Inuit in Greenland, Canada, and the US. Other major groups include the Nenets, Khanty, Evenk, and Chukchi in Russia and the Aleut and Yupik in the United States.⁵⁷ Indigenous populations are experiencing faster population growth than any other Arctic demographic.⁵⁸ Climate change and the resultant economic development are threatening the economies and lifestyles of indigenous circumpolar peoples in all Arctic countries, which have traditionally revolved around subsistence hunting and fishing.⁵⁹

Indigenous and nonindigenous Arctic communities in Russia and the Western Hemisphere have lower average educational levels and experience higher levels of social and health problems than southern communities and Western European Arctic communities.⁶⁰

FORECAST AND IMPLICATIONS: The Arctic population level will remain directly tied to economic resource exploitation, and migration from rural to urban areas will continue. As polar ice continues to recede and the Arctic population becomes increasingly urbanized, indigenous communities will experience added pressure to abandon traditional lifestyles. The result will likely be increased cultural assimilation in Russia, with some pushback in

Western Hemispheric countries. Perceived loss of culture will primarily manifest in the form of increased health and societal problems (e.g., poverty, crime). However, unrest associated with grievances has historically been localized with no indications of potential insurgency or violence on a wide scale by 2035.

INFORMATION: DISPARITY OF REGIMES

The information environment in the Arctic varies significantly with infrastructure, population centers, and political systems, which are themselves influenced by the physical environment and availability of economic resources. Consequently, the Western European Arctic is comparatively advanced compared to the more isolated North American Arctic and the strictly controlled as well as isolated Asian Arctic. In Scandinavia, even the most rural communities are connected to global networks. Television is the primary information medium in Russia. North American Arctic areas have access to all media, but connectivity is slow and expensive.

Denmark (including Greenland), Finland, Norway, and Sweden are within the top five countries for press freedom, and Canada ranks within the top twenty, according to Reporters without Borders.⁶¹ In Greenland, the primary information source is public radio and television, although there are local networks. There are no daily newspapers. Internet, while widely available, is provided by a state-owned corporation.⁶² Finland has ubiquitous print, radio, television, and internet access, even in remote areas, with independent media and an independent, self-regulatory council to maintain press credibility.⁶³ Norway is a world leader in internet access and news consumption. Information is distributed across all media, which operate without government pressure.⁶⁴ Sweden's media culture is characterized by independence and self-regulation. The country has numerous private and public-service media sources that exhibit a general trend of decreasing politicization.⁶⁵ Internet access is available but expensive and bandwidth is low in Canadian Arctic communities.⁶⁶ English and French broadcasting from southern communities predominate television and radio, although time is allocated for aboriginal programming and there are aboriginal broadcast networks.⁶⁷ Public radio connects remote rural communities.⁶⁸ The Russian government exerts significant influence over all Russian information outlets. Television is the most pervasive information medium in Russia. A few radio stations and a handful of newspapers carry substantial information. The internet is a growing but distrusted medium.⁶⁹

Both Russia and China actively employ information warfare to advance their respective Arctic interests. Russia uses information operations to project power, legitimacy, and sovereignty, which includes militarizing Arctic policy and advancing disinformation globally. Examples range from manipulating news media to reinterpreting political statements by U.S. politicians, to misrepresenting Russian Arctic military capabilities. China has employed a subtle approach nested within its "three warfares" strategy (strategic psychological operations, media manipulation [both overt and covert], and legal warfare) by introducing terminology such as "near-Arctic power" in official venues while

pursuing status as an Arctic Council observer in an attempt to legitimize future Arctic endeavors.⁷⁰

FORECAST AND IMPLICATIONS: With the exception of the Western European Arctic, which is more densely populated with a milder climate, vast distances and extreme conditions between communities will continue to shape and challenge information networks. By 2035, these networks will remain slow and expensive compared to the rest of the world. Television and radio will remain the primary information media in the Russian Arctic while the internet will continue to grow in importance in North American Arctic regions. China will likely continue to improve its information capability and access by offering telecommunications infrastructure investment and support, geared toward supporting Chinese rights to Arctic resources, despite any pushback from the West. Russia will continue its current aggressive information and influence operations in the region.

INFRASTRUCTURE: INSUFFICIENT AND UNDER DEVELOPMENT

The remote, extreme environment shapes Arctic infrastructure, resulting in significant regional variations. Infrastructure follows population clusters and economic activity as in any other region; however, in the Arctic it is more difficult and expensive to build and maintain.

The Arctic climate increases demand and cost of electricity—often requiring communities to generate electricity locally—and reduces the practicality and ability to use other forms of energy.⁷¹ Although most mainland Western European Arctic areas are connected to robust regional power grids, local grids predominate Asian and North American Arctic communities.⁷²

The NWP and NSR are important seasonal waterways.⁷³ As of 2017, the NSR included 17 maritime ports. There are no deep-water ports in the U.S. Arctic except Dutch Harbor in the southern Bering Sea. Canada's only northern deep-water port with reliable facilities and overland infrastructure is Churchill, which is actually south of the Arctic Circle in Hudson Bay. Greenland, Norway, Iceland, and Russia have several deep-water ports, including the largest Arctic port at Murmansk, Russia.⁷⁴ Arctic rail and road infrastructure is generally sparse, particularly in Asia and North America. Russian overland infrastructure is not well-connected to other European networks.⁷⁵

Communication is possible in the Arctic but bandwidth and systems are limited, with very high frequency (VHF), high frequency (HF), and iridium as the principal means. Communications in the more densely-populated European Arctic are generally superior to the North American and Asian Arctic, where vast distances between isolated communities and a lack of infrastructure and providers inhibit connectivity.⁷⁶

Climate change is also taking a toll on established Arctic infrastructure. Most Arctic infrastructure is built on permafrost in areas at risk for thawing in the near future; in

Russia, a third of Arctic infrastructure could be severely damaged by thawing.⁷⁷ However, growing interest in economic exploitation has stimulated infrastructure investment. Approximately 900 Arctic infrastructure development projects were in progress as of 2016, with \$1 trillion in total expected investments through 2031.⁷⁸ Chinese companies have been increasingly investing in transportation and energy infrastructure projects across the Arctic.⁷⁹ Development projects are underway to connect Russian road and rail networks with other European Arctic countries.⁸⁰ The Chinese company Huawei has been bidding to offer internet coverage in the Arctic and SpaceX is planning to provide global internet coverage with a satellite constellation.⁸¹ These investments mitigate the pressure on infrastructure posed by isolated communities and climactic extremes, but are unable to achieve parity with more accessible and better connected locations.

FORECAST AND IMPLICATIONS: Infrastructure development investment will continue to grow in proportion to Arctic accessibility, resource potential, and political interest. In the short term, maritime port infrastructure will grow fastest of all sectors, with mineral resource extraction growing only as access improves. Development along the NSR will outpace development along the NWP because of preexisting infrastructure and accessibility. Costs to maintain and repair infrastructure will increase as permafrost melting continues, weakening and undermining existing structures. The northernmost communities will experience the most severe impact. This degradation will result in gradual but significant investment requirements. Russia, which has the largest Arctic population and more Arctic territory than all other countries combined, will experience the greatest economic impact. Diversion of resources to populated areas may slow the development of infrastructure between isolated communities. The comparatively mild climate of the European Arctic ensures that by 2035 it will remain more connected and developed than Asian or North American Arctic areas.

PHYSICAL ENVIRONMENT: DYNAMIC EXTREMES

The Arctic OE is a unique physical environment that poses its own challenges. Maritime and land areas have conditions not present in other regions of the world. The climate is extreme. The electromagnetic and space environments have accentuated effects.

The Arctic is predominantly a maritime environment. Major bodies of water include the Arctic Ocean, the Chukchi Sea, the East Siberian Sea, the Laptev Sea, the Kara Sea, the Barents Sea, the Greenland Sea, the Beaufort Sea, the Bering Sea, and Baffin Bay.⁸² The Arctic is covered by drifting ice that reaches encircling land masses during winter and retreats during summer.⁸³ Sea ice topography varies, with larger features in the central Arctic and near the Canadian coast being associated with multi-year ice.⁸⁴ Arctic thawing trends suggest the summer ice sheet and permafrost will decline by double-digit percentages, but ice-free summers will likely not be recurrent before the 2030s at the earliest.⁸⁵

Portions of northern Asian, European, and North American land masses and multiple archipelagos surround the Arctic seas. Land topography is extremely varied, ranging from

mountains reaching above 3,000 m (10,000 ft) in elevation to lowland plains. There are large geologic shields in Canada and Scandinavia. Arctic permafrost reaches 450 m (1,500 ft) in the Western Hemisphere and 600 m (2,000 ft) in Asia. Poor drainage in lowland areas produces shallow lakes and boggy peatlands. Glaciers cover approximately 40 percent of Arctic land, including much of Greenland. Biomes include subarctic boreal forests south of the tree line and tundra north of the tree line.⁸⁶ Natural hazards include ice islands and icebergs in maritime areas, permafrost on land, and extreme temperatures.⁸⁷

The Arctic climate is characterized by long, dark, cold winters and short, cool summers with continuous daylight. Polar maritime climates near the Atlantic and Pacific coasts generally have milder temperatures and greater amounts of snowfall, while polar continental climates have harsh temperatures and light snowfall.⁸⁸ The Arctic Oscillation is a major weather pattern that involves an inverse relationship between Arctic and middle latitude pressures and temperatures. Additionally, small cyclones appear regularly above the Arctic Ocean during winter. Cyclones occur near the Aleutian Islands and Iceland; anticyclones occur over Siberia and the Beaufort Sea.⁸⁹ Temperatures vary by location. For example, in Oymyakon, Siberia, mean temperatures range from -46 °C (-51 °F) in winter to 15 °C (59 °F) in summer, while in Tromsø, Norway, mean temperatures range from -3 °C (26 °F) in winter to 12 °C (54 °F) in summer.⁹⁰ The Arctic climate is changing more rapidly than other regions, with annual sea ice minimum volumes at record lows since 2007, although it is uncertain when Arctic seas will be considered ice-free or how long it will take to reach that point.⁹¹ The Greenland ice sheet is retreating generally but inconsistently.⁹² Permafrost is receding in all regions.⁹³ This could potentially result in the reemergence of pathogens preserved in permafrost and facilitate the northward spread of current, geographically-restricted pathogens.⁹⁴

The Arctic is a unique electromagnetic environment. The Earth's magnetic field is strongest in the northern polar region, but magnetic north is not the point of maximum magnetic strength. There are two maxima, one in Central Canada and the other in Siberia.⁹⁵ The geomagnetic pole itself is not fixed. As of 2019, it was located at 80.6 °N 73.1 °W and the north magnetic pole was located at 86.4 °N 175.3 °E.⁹⁶

The space domain over the Arctic poses unique challenges. Geostationary satellites cannot provide coverage at Arctic latitudes because their line of sight is obstructed by the curvature of the Earth, so all available satellites have moving ground tracks. The Arctic experiences comparatively higher levels of charged particle levels than lower latitudes during ionospheric storms, particularly during winter months.⁹⁷ Remote sensing is complicated by extended periods of darkness in the winter.

The combined result is a physical environment that has greater influence over other OE variables than is often encountered in lower latitudes. Some physical environment effects, such as climate, vary in amplitude between subregions. Other effects, such as day length and electromagnetic interference, remain consistent longitudinally but will vary with latitude.

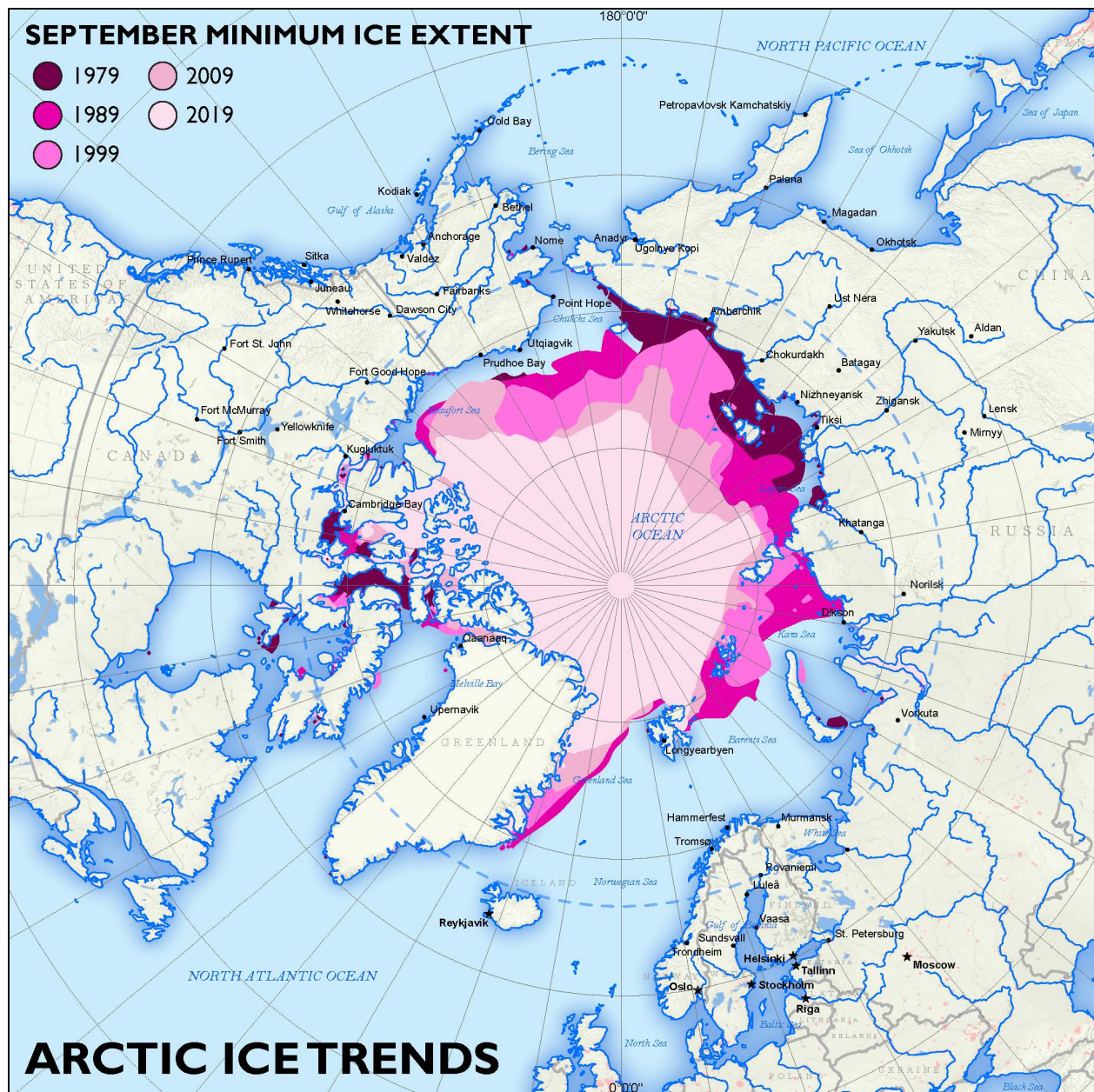


Figure 6. Illustration of the changes in Arctic ice trends over the last 50 years.

FORECAST AND IMPLICATIONS: Ice islands and icebergs will continue to be maritime hazards for the foreseeable future and Arctic shipping will remain seasonal through at least 2035. Although permafrost recession represents a future challenge, particularly in Russia, it is unclear if this will manifest significantly in the near future. Boreal forests will advance northward slightly but overall tundra will continue to predominate, with poor drainage in lowlands. Space support will remain challenging because of lack of geostationary satellite coverage, elevated charged particle levels, and extended periods of darkness.

TIME: DISSOCIATED PERCEPTION

The Arctic is a unique temporal region because of the combined effects of international conventions on times and dates as well as the axial tilt of the Earth itself. This variable results in physical, cognitive, and affective impacts on individual persons. It has also shaped the development of culture throughout the region.

Time zones become less meaningful closer to the geographic North Pole, where all lines of longitude converge; by convention, Greenwich Mean Time (Zulu time) is used at the pole itself. Russia's Arctic regions span seven time zones; Greenland's and Canada's Arctic regions each span four. Arctic daylight hours are also exaggerated compared to lower latitudes. The sun does not rise at all near the winter solstice, with daylight limited to protracted periods of twilight, and does not completely set near the summer solstice.

The effect of this phenomenon is that measured time is dissociated from immediate perception. The long periods of darkness in winter and daylight in summer are associated with sleep disruption for personnel assigned to high latitudes. The extended periods of darkness in particular have deleterious effects on physical and psychological health and personnel performance.⁹⁸

For indigenous communities, perceptions of time and space often differ from other cultures. For example, in some cultures, approaches to long-term planning and risk management are difficult to align with traditions from other regions.⁹⁹ In other cultures, concepts such as seasons are tied to animal migrations rather than directly to the Earth's motion.¹⁰⁰

FORECAST AND IMPLICATIONS: The Arctic will always remain a unique temporal region and its impacts will always affect forces operating in high latitudes. The Arctic crosses all time zones and multiple geographic combatant commands, operational forces cannot expect to have ideal contemporaneous battle rhythm with parent commands. Compared to other parts of the world, formations can expect to experience decreased efficiencies and elevated incidences of injury and illness, particularly during winter. Integrated planning and coordination with indigenous partner forces and local civil authorities may be challenging because of perceptions of expectations and communication of time.

THE FUTURE OF THE ARCTIC

As a direct result of the physical environment, the Arctic is changing rapidly but predictably. Population growth and infrastructure development will continue to be tied to economic activity. This will certainly include Russian ports and maritime facilities along the NSR, as Arctic shipping routes will see more volume and longer seasons as sea ice retreats. It will also likely include the areas most accessible for fossil fuel exploitation, although the rate of growth will be tied to global energy prices. Arctic countries will continue to be the largest investors. As resource exploitation becomes more lucrative,

non-Arctic countries will increasingly conduct research and posture for future claims in international waters.

Security of economic resources will remain the principle driver of military activity for all parties, especially Russia, although the Arctic will continue to be used for global strategic military activities, such as deterrence. The overall governance of the Arctic will not change significantly. Some progress may be made in resolving international maritime claims and there will likely be growth in the number of interested parties commensurate with economic resource availability. Even remote Arctic areas will become increasingly interconnected to global telecommunications networks, particularly in areas with increased natural resource exploitation. Nevertheless, access will remain more expensive and less reliable than the rest of the world because of geographic constraints.

Barring an unexpected change in its domestic politics or economics, Russia will be the dominant Arctic power and U.S. competitor through 2035. It is unlikely that even combined efforts by the remaining Arctic actors will reach or surpass Russian levels of capability and capacity in the region. China's presence will continue to grow in the Arctic, primarily through investment in infrastructure associated with the Polar Silk Road and global communications. It is unlikely that China will conduct significant energy resource mining by 2035, although Chinese Arctic scientific research endeavors will likely grow in areas associated with fuel and mineral resources, as well as shipping routes.

Black swans are by definition unpredictable, but there are possible, though less likely, events that could lead to sudden changes in Arctic trends. New discoveries of resources or technology, such as robotics, which drastically change the accessibility or value of Arctic resources would accelerate international interest in the region. A rapid but enduring shift in global energy prices will also directly impact interest in Arctic resources. An unexpected change in the rate of global warming in the Arctic could also alter the tempo of international activity. A rapid cultural or political shift in one of the Arctic countries or alliances, e.g., a partner leaving NATO or a significant regime change in Russia, could decrease stability in the region.

CONSTRAINTS TO MULTI-DOMAIN OPERATIONS IN THE ARCTIC

The Arctic OE's uniqueness manifests in all warfighting domains. The availability and quality of space support is degraded. The cyberspace environment varies significantly depending upon locale. Air operations require additional support, specialized equipment, and augmented training. Seas dominate the region, but are generally unavailable. The terrestrial environment is characterized by all manner of climatological and geological extremes.

SPACE. The Arctic poses a challenging OE for space support to military operations. Geostationary weather and communications satellites neither provide coverage nor supplement low Earth orbit platforms. Long periods of darkness in winter and the variable albedo of snow and ice limit the capabilities of optical overhead imaging platforms. The

Arctic is susceptible to greater atmospheric electromagnetic interference than lower latitudes, multiplying, extending, and exacerbating outages of all wireless communications. Position, navigation, and timing satellites also have degraded performance.

CYBERSPACE. Cyberspace operations conducted in the Arctic will have to cope with comparatively poor quality communications infrastructure and dispersed, isolated population centers in all areas except the Western European Arctic. Cyberspace operations will require extensive reliance upon space assets and, in some cases, competitors' communications infrastructure. This could, in turn, affect the security of military information networks and complicate extending, maintaining, and sustaining networks. Offensive operations will have to account for disparate information regimes. The combined effects of extreme climate and isolated population centers means that cyberspace operations against infrastructure and services that would be disruptive in other regions could be lethal in the Arctic.

AIR. Air operations require cold-weather operational capability. With the exception of global strike assets, aircraft would have to be sea based or forward positioned in multiple partner nation territories; these countries would have varying ability and will to sustain air operations. Long periods of darkness in winter months will require ubiquitous night-vision capability for much of the year. Emplacements for ground-based radar are few and geographically dispersed because of limited infrastructure and the cold, predominantly maritime environment.

MARITIME. Maritime movement and sustainment will be restricted to a few months during the warmest times of the year. Even then, icebreakers may be required due to floating ice and unpredictable ice sheet variations. Regardless of country, sea basing for air and amphibious forces, local sea control, maritime sustainment, and maritime support to land forces will require ice-class ships and icebreaker escorts even during summer months in thin-ice waters. Year-round operations will only be possible for ships with the highest ice-class ratings available.

LAND. Arctic land operations require the capability to operate on diverse, extremely varied terrain that is dissimilar to the cold-weather mountain environments in which the U.S. has extensive recent experience. Operations require significant time and resources dedicated to survival and sustainment. Geographically dispersed population concentrations necessitate long sustainment lines and the ability to transition rapidly from operations in remote, rural areas to dense, urban areas.

IMPLICATIONS FOR ARMY WARFIGHTING FUNCTIONS IN THE ARCTIC

The unique complexities of the Arctic OE across all domains will challenge the U.S. Army in each of the warfighting functions. In an Arctic conflict, forces would have to operate with degraded situational awareness, precision, and communications than are available in present-day contingency operations on more familiar terrain. Forces will have to

traverse long distances across difficult terrain in hazardous conditions and conduct amphibious operations in remote locations. More effort will be devoted to survival rather than decisive action.

COMMAND AND CONTROL. Command and control in Arctic operations will be characterized by unreliable communications and dispersion of forces, which will challenge maintaining a common operational picture, developing shared understanding, and expressing commander's intent. Interoperability and capacity challenges with partner forces, along with decreased precision and availability of supporting fires due to environmental factors as much as enemy disruption, will challenge building mutual trust. Disproportional expenditure of energy on survival will limit the force's ability to exercise initiative and accept risk. This will directly affect the tempo of combat, resulting in episodic battles and slow movement. Additionally, commanders will have to account for environmental hazards that are as lethal as—or more lethal than—enemy action.

MOVEMENT AND MANEUVER. Movement and maneuver will be slow, difficult, and require purpose-built equipment for success in the Arctic. Winter operations will require the ability to move and maneuver across snow and ice in the coldest conditions during long periods of darkness. Roads may be completely snow-covered during much of the year. Conversely, summer operations will require traversing ubiquitous lakes and peat bogs as well as varied, mountainous terrain. Summer operations will frequently have to be conducted without cover of darkness. Satellite navigation will be imprecise and unreliable at best and nonexistent in some cases. As a result, formations using nonspecialized equipment will have slow movement and limited ability to maneuver.

INTELLIGENCE. Effects of the Arctic environment will result in degraded intelligence compared to operations in lower latitudes. Limited satellite availability and communications interference will require organic resources for overhead information-gathering functions and will reduce the availability of cloud-based systems and analytic reach-back support. Lack of persistent, broad-area satellite coverage will decrease precision of weather forecasting, particularly long-range forecasts. Satellite mapping will require active sensor systems to offset the limitations of electro-optical systems in snow-covered terrain. There will likely be shortages of reliable interpreters and translators, particularly when conducting stability operations with indigenous circumpolar and cross-border peoples, who represent a disproportionately higher number of dispossessed communities.

FIRES. Fires in Arctic operations will often be less precise than other places because of degraded electromagnetic communications and position, navigation, and timing satellite support. Sea-based tactical air support would be limited to summer months, if available at all. Lack of information infrastructure means nonlethal fires would have limited reach outside of Western European Arctic theaters. These conditions will make fires less effective and increase expenditures to achieve the desired effects.

SUSTAINMENT. Sustainment will be one of the biggest challenges in Arctic operations. Much like movement and maneuver, sustainment will require purpose-built equipment to

contend with the harsh conditions. Moreover, transportation will have to account for the unavailability of maritime support, long sustainment lines, and protracted operational timeframes. Logistics will have to account for increased fuel requirements and specialized materiel requirements across all classes of supply, and the challenging terrain will require additional maintenance support to equipment.

PROTECTION. The Arctic OE will require robust protection measures to preserve the effectiveness and survivability of friendly forces, not only against adversaries but against the extreme environment, which will affect survivability as much as the enemy. Disruption of sustainment, even for a short period, can significantly degrade readiness and effectiveness of Arctic forces, particular during winter months.



U.S. COMPETITORS IN THE ARCTIC

Russia and China are the only U.S. competitors actively involved in the Arctic. Russia has the preponderance of Arctic interests by far, and is working to improve its already significant Arctic capabilities. These are primarily focused on protecting growing economic interests in the Russian Arctic rather than projecting power, except in its near abroad, which consists of former Soviet

countries on the Russian periphery. There are no indications that this will change significantly by 2035. Conversely, China has a much smaller Arctic footprint but is actively working to establish itself as a major Arctic player. Like Russia, Chinese Arctic ambitions are primarily economic, although both countries will use all instruments of national power to seize opportunities that may emerge in the region to challenge U.S. global leadership. At present, this manifests in diplomatic, information, and economic power. By 2035, increased military presence by both countries can be expected. Russia and China are also willing to work together in the Arctic, as evinced by references to the Shanghai Cooperation Organization (SCO) in their respective national security and defense policies.

Conflict over the Arctic is unlikely, but conflict in the Arctic is possible because the Arctic represents a significant theater in a broader great-power conflict.

RUSSIA'S ARCTIC INTERESTS: DETERRENCE AND RESOURCES

Russia will be confronting diverse strategic challenges in the near future. The country's projected economic growth will be challenged by unreliable global energy prices, international pressure, and probable domestic political instability.¹⁰¹ Additionally, Russia is facing demographic decline, with uncertain implications for its economic and military power. It perceives significant threats to include NATO expansion, growing U.S. influence in its near abroad, improved U.S. global strike and ballistic missile defense capabilities, and destabilization near Russian territory.¹⁰² Russia's policies toward the Arctic—in particular its claims and efforts to develop and exploit energy resources—indicate that it will rely upon Arctic resources to mitigate the country's strategic challenges.

Many of these global challenges converge in the Arctic.¹⁰³ Russia's interests in the Arctic are defined by its desire to defend and exercise its sovereignty and capitalize on economic growth opportunities. Much of Russia's strategic deterrence capability is based

in the Barents Sea, enabling a short route for weapons to reach North America but at the same time creating a target to be defended. As the land route to this strategic area, Russia also needs to defend the Kola Peninsula.¹⁰⁴ It has more Arctic territory than any country, as well as the largest Arctic population.¹⁰⁵ Additionally, Russia's economy depends upon Arctic energy resources and use of the NSR. Russia is also anticipating emerging economic opportunities that will be created by receding Arctic sea ice.¹⁰⁶ Consequently, Russia's interest in the Arctic will continue for the foreseeable future. Russia's public policy statements corroborate this assessment.

RUSSIA'S ARCTIC POLICY: PROTECT AND DEVELOP TO EXPLOIT

Russian national policy nests the Arctic within a broader global strategy, but it is disproportionately emphasized compared to other regions.¹⁰⁷ Russia's 2015 National Security Strategy mentions the Arctic three times: in the context of global exploitation of maritime fossil fuel resources; development of public-private relations in the security sector; and "mutually beneficial" international development.¹⁰⁸ These items are principally economic initiatives; even security activity appears to concentrate on protecting shipping routes and natural resources.

According to Russia's 2016 Foreign Policy Concept, the country's stated Arctic policy is "aimed at preserving peace, stability and constructive international cooperation in the Arctic."¹⁰⁹ The policy emphasizes the sufficiency of the current international legal and diplomatic architecture to handle foreseeable disputes associated with governance, territorial rights, and disputes in the Arctic, namely because Russia perceives the current international regime as working in its favor. The country maintains that the Arctic states have special rights and responsibilities for Arctic development and ties use of the NSR for Russian and international shipping to that development. Russia selectively uses the international system to push its claims by recognizing the Arctic Council, the Arctic Five, and the Barents Euro-Arctic Council as legitimate cooperative associations for Arctic affairs.¹¹⁰ Interestingly and not coincidentally, Russia's Foreign Policy Concept omits mention of the Arctic Security Forces Roundtable—from which Russia has been expelled—as an international forum.

Russia's 2015 National Maritime Doctrine addresses the Arctic more extensively than either of the preceding two documents. It identifies Russian Arctic policy drivers as—

- Ensuring Russian fleet access to the Atlantic and Pacific Oceans.
- Natural resources in the exclusive economic zone and continental shelf.
- Growth of the NSR.
- The Northern Fleet mission to defend Russia.¹¹¹

Russia's Principles of Arctic State Policy, signed in March 2020 and covering the period until 2035, includes both development and security provisions. Among Russia's Arctic challenges, the document includes communications and transportation infrastructure limitations, emigration, and an increasing Arctic security posture by international

competitors. For development, it prioritizes improving conditions and promoting growth of both indigenous and nonindigenous populations; developing energy resources and the NSR; and protecting the environment. Security provisions include improving and modernizing air and maritime surveillance, coastal defense, and force strength.¹¹² The policy was enacted along with additional laws and regulations aimed at encouraging NSR development and natural resource exploitation.¹¹³

RUSSIA'S ARCTIC POSTURE: POSITION TO DOMINATE

Russia's Arctic posture aligns with these interests and strategy and suggests both intent and growing capability to use the OE variables unique to the Arctic to gain advantage. Russian military activity in the Arctic will play a prominent role in its overarching global strategy.¹¹⁴ The country is also employing its instruments of national power in the Arctic.¹¹⁵ Russian efforts to shape the region to its benefit include ongoing efforts to legitimize maritime economic claims, establishing mechanisms to control the information environment, and preparing its military for conflict in or involving the region.

Russia is engaged in scientific studies of the Arctic basin (supported by its information architecture) to legitimize claims before international bodies that the Lomonosov Ridge is connected to Russia's continental shelf. Canada also claims portions of the Lomonosov Ridge.¹¹⁶ If Russia's claim is ultimately accepted by the international community, the country would be able to extend maritime exclusive economic zones to exploit central Arctic natural resources.

Russia is working to establish information dominance in order to provide increased situational awareness, communications, and targeting for the military and to facilitate narrative control over Arctic rights and exclusivity. Physical measures include expanding Arctic satellite coverage, with an additional 12 Earth-imaging satellites planned to be in orbit by 2030. Improved satellite coverage will have dual applications for both military and civilian purposes.¹¹⁷ Moreover, Russian media continues to advance the narrative of Russian Arctic legacy and supremacy.¹¹⁸

In addition to positioning military forces and a plethora of equipment and infrastructure in the Arctic, Russia has been improving forces for Arctic operations through modernization and technological investment. Military improvements cover a broad range, with investments in—

- Bases to support long-range aircraft operations and coastal patrols.
- Upgraded air defense.
- Improved vehicle capabilities.
- Enhanced drone and robotics technology for Arctic operations.
- Upgraded air and missile defense.
- Extensive training of forces to operate in the region.¹¹⁹

To access the Arctic seas, as of 2019 Russia had developed a polar ice breaker fleet that outnumbered the rest of the world's fleets combined.¹²⁰ As Russia considers expanding this fleet—especially its nuclear icebreakers—that number is likely to continue to grow.¹²¹ Furthermore, Russia is modernizing ports along its Arctic coast to improve its capability to use the NSR.¹²²

Russia maintains that its extensive Arctic capabilities give it additional rights, and has claimed authority to regulate ships transiting international waters in the NSR.¹²³ This policy has been protested by other nations, who state that it violates international laws—specifically the United Nations Convention on the Law of the Seas (UNCLOS).¹²⁴ However, UNCLOS—along with the Polar Code—may be inadequate for the unique Arctic environment: Ambiguities and inconsistency between them have resulted in the Arctic nations enacting their own navigation laws and policies.¹²⁵

Russia's ability to continue military modernization and improvement, including of Arctic forces, is directly tied to the economic and social variables. Both Russia's military investment and its economy depend upon energy prices. Russian personnel costs are likely to rise as the Russian population declines.¹²⁶ The country's ideal end state in the Arctic is one in which it controls enough Arctic resources—particularly energy resources—to ensure national economic stability and growth. Additionally, Russia desires uncontested control over all shipping in the NSR and sufficient military power to deter any threats to the country from all northern approaches.

CHINA'S ARCTIC INTERESTS: SECURE RESOURCES AND TRADE

China's guiding national strategic interest is to preserve Communist party rule.¹²⁷ To ensure this, China must also sustain economic growth and development, secure its status as a great power, and safeguard its interests abroad.¹²⁸ Despite some moderation, China is experiencing and will likely continue to experience economic growth despite uncertainties associated with international trade disputes.¹²⁹ The country's growing demand for energy is slowing, but will not stop. Despite efforts to advance renewable energy, China will continue to be the world's largest energy consumer for the foreseeable future.¹³⁰ The country is also undergoing demographic contraction, and it is unclear when the full force of the population bubble will be felt on its economy.¹³¹

Chinese Arctic interests intersect with those of Russia. Although Chinese interest in the Arctic dates back decades, recent aspirations are dominated by economic considerations. These include access to Arctic natural resources—particularly energy resources—and expanding maritime shipping routes.¹³² Militarily, China's principle interest in the Arctic is nuclear deterrence, especially against potential missile threats across the Arctic and from ballistic missile submarines.¹³³

CHINA'S ARCTIC POLICY: INVEST TO GROW AND LEGITIMIZE ACCESS

China's official policy toward the Arctic reflects these interests. China's 2018 Arctic policy whitepaper states that China desires to "understand, protect, develop and participate in the governance of the Arctic."¹³⁴ The paper enumerates China's economic interests in the Arctic as shipping, mineral resource exploitation, fisheries exploitation, and tourism. Chinese policy describes the country as a "near-Arctic state"—a concept that is not recognized internationally—and envisions the Arctic as a "Polar Silk Road," forming a component of the "One Belt, One Road" initiative. Other interests include scientific research, environmental protection, and regional stability.¹³⁵ Scientific endeavors are likely dual purpose, designed to support military requirements and to align with China's global military interests.¹³⁶

China lacks transparency about its military and security policy in the Arctic. Its defense policy omits specific reference to the Arctic; however, China's *National Defense in the New Era* enumerates its defense priorities. These include, among others, deterring aggression, reinforcing political security and stability, supporting development, and safeguarding interests overseas and in the global commons.¹³⁷

CHINA'S ARCTIC POSTURE: USE PARTNERSHIPS TO INCREASE POWER

China has been employing its instruments of national power to advance its strategic and military posture in the Arctic. Unable to become a member of the Arctic Council without having Arctic territory, China has managed to gain observer status.¹³⁸ This position provides the country with awareness of international Arctic activities and increases its visibility among interested parties. China is also growing its partnerships and cooperation with Russia. These relations are largely transactional and could eventually lead to competition rather than cooperation on some fronts, but China will work with Russia through 2035 for Arctic access.¹³⁹

China uses artful language in its attempts to establish legitimacy in the Arctic. The country rationalizes its innovative "near-Arctic state" status by claiming the inability of Arctic nations to exploit resources in international waters and by emphasizing the significant impact of climate change in the Arctic on its national interest. China's Arctic policy emphasizes that the country has been involved in Arctic exploration since the 1920s—although this predates the Chinese Communist Revolution. This narrative is intended to challenge the Arctic littoral nations' claims to exclusivity over the central Arctic region and to present the Arctic as a global commons that China has a right to exploit.¹⁴⁰

China's approach to military power in the Arctic is measured and subtle compared to its use of other instruments of national power.¹⁴¹ However, it is important to note that there is a military dimension to Chinese activity in the region. China conducts freedom of navigation operations in the Arctic—including in U.S. territorial waters. The country also participates in international military and naval exercises, particularly with Russia.¹⁴² Although China has historically prioritized diplomatic and economic measures to advance its Arctic agenda, it has been increasing its military capability in the Arctic since 2014. This includes moves to enhance its diplomatic and legal position in the Arctic, investing

in Arctic surveillance and navigation capability, and proposed military deployments to protect Arctic shipping.¹⁴³

Through direct government action and, more commonly, state-owned corporations, China is investing in multifarious development projects across the Arctic. Select examples include—

- Building gas pipelines in Russia.
- Modernizing ports and railways along the NSR for incorporation into the Polar Silk Road.
- Investing in Finland's Arctic remote sensing infrastructure.
- Offering to improve communications infrastructure in the Canadian North.
- Building scientific outposts in Iceland and Sweden.
- Offering to invest in infrastructure projects benefiting indigenous communities.¹⁴⁴

China is also expanding its ability to physically access the Arctic: It already has two diesel-powered polar icebreakers and is developing a nuclear-powered one.¹⁴⁵

ASSESSMENT OF COMPETITOR APPROACHES TO THE ARCTIC

The intertwined dynamic forces of climate change and economic development shape the Arctic OE. As the Arctic continues to thaw, it will become increasingly accessible and lucrative. Shipping seasons will lengthen and resource exploitation will become more feasible, while loss of permafrost will undermine the strength and capacity of current infrastructure. The result will be growing activity in the Arctic by state and nonstate entities, which in turn will lead to increased investment in Arctic infrastructure. These changes will affect all OE variables. As interest in the Arctic grows, U.S. competitors could use disputes between allies over Arctic claims to exploit and foment division. Disputes over the Arctic could exacerbate strained relationships in competition and, in a worst case scenario, be a contributing factor to conflict.

Conflict over the Arctic is unlikely, but conflict in the Arctic is possible because it represents a significant theater in a broader great-power conflict. The most dangerous potential threat to the U.S. and its allies remains Russia's ballistic missiles—including nuclear weapons—which are based in the Arctic and would likely transit it in the event of a large-scale conflict. If such a conflict were to occur, a large-scale ground component in Scandinavia would also seem likely, as this is the shortest route to Russia's strategic Kola Peninsula. Additionally, there are potential naval and amphibious operations, particularly in the strategic maritime chokepoints of the Bering Sea or the Barents Sea Opening. China cannot compete militarily in the Arctic at present. However, Chinese ballistic missile submarine patrols in the Arctic could become a reality by 2035.

Throughout this forecast period, Russia will be a dominant force and will continue to be the U.S. competitor with the largest Arctic presence. The country's comparatively robust Arctic posture will ensure it maintains a greater presence in Arctic international affairs

than any other individual country and, frequently, a louder voice than all other countries combined. Russia will be better situated to exploit the Arctic's increasingly lucrative resources and intends to do so.

Russia is presently capable of threatening NATO and other allies and partners in the Arctic across all warfighting domains; it will still have and will likely have improved this capability by 2035. The country is particularly interested in securing its near abroad, only a small part of which is in the Arctic. A lower-scale or irregular conflict involving Scandinavia is the most likely potential conflict scenario. The patchwork partnerships and alliances across Europe increase the likelihood of the U.S. being drawn into a conflict. Should this happen, interoperability with many of these partners would represent a challenge. Moreover, indigenous communities historically cross national boundaries; their mobility and access represent both opportunities and challenges to military operations. Isolated engagements are also possible in the Arctic, particularly in disputed spaces and near jurisdictional boundaries, but would require particularly egregious conduct to result in significant escalation.

The Russian military is experienced, trained, equipped, and well-positioned to fight in the Arctic. The country's investment in Arctic operational capabilities will enable its military forces to operate and sustain themselves for extended periods of time, year-round, in isolated locations in the Arctic—particularly in the Russian Arctic. Increased infrastructure interconnectedness between northwest Russia, Norway, and Finland will facilitate sustainment of forward-deployed Russian ground forces should a conflict occur. Multiple formations are permanently stationed in the Arctic and other units train in the Arctic year-round. High-latitude rotations are routine, rather than exceptional. Investment in icebreakers, primarily meant to support economic interests, also means Russia will be able to challenge or exert sea control year-round, as well as project and sustain power across Arctic waters to a significantly greater extent than any of its rivals. Consequently, Russia would have significant advantages within its territory and against any individual European Arctic country because of force strength, prepositioning, purpose-designed equipment, and extended ability to communicate and maneuver.

China's operational reach into the Arctic currently is itinerant and aspirational, but will grow as it improves its maritime capability and increases its Arctic presence. China will not abandon its desire for Arctic resources. In the short term, the country will have to temper its arguments to ensure Russian cooperation on military affairs and to guarantee access to the Russian-controlled NSR. By 2035, China may be able to use economic leverage to gain greater influence over this route. Instead of rapid expansion, significant Chinese exploitation of Arctic resources will only be attainable in the long term. By 2035, China may have ability to operate in and exploit Arctic resources comparable to some Arctic nations. Large-scale Chinese exploitation of resources is unlikely, but may be underway on a small scale, dependent upon cooperation with international partners.





CONCLUSION

The Arctic is as challenging an OE as any other on Earth. U.S. allies, partners, and potential adversaries all have growing and competing interests in the region. Global dynamics coalesce with growing economic value, varied critical and information infrastructure, and a rapidly changing physical environment. The two most capable U.S. competitors are particularly interested in solidifying and growing influence in the region, and Russia already has a large foothold. Access to and control of the Arctic and its resources are themselves unlikely to lead to armed conflict, at least through 2035. However, the Arctic is a potential theater for global or regional conflicts involving great powers and alliances, and it is unlikely that these would abandon their claims. As the U.S. Army marches toward the mid-21st Century, maintaining visibility and understanding of the Arctic OE could prove important in a potential conflict.

CONSIDERATIONS FOR TRAINING AND SCENARIO DEVELOPMENT

- *Heightened focus and assertiveness by U.S. competitors.*
- *Nuclear deterrence activities in the region.*
- *The intersection of economic, scientific, and security activity in the region.*
- *Adversary influenced if not dominated information architecture.*
- *Unpredictable degradation of communications and space support.*
- *Large geographic dispersion of forces.*
- *Battle rhythms crossing multiple time zones.*
- *Slow and difficult movement and protracted operational time frames.*
- *Dependence upon purpose-built equipment.*
- *Extreme climactic conditions with degraded weather forecasting accuracy.*
- *Less precise fire support due to unique position, navigation, and timing challenges.*
- *Geographically dispersed population centers.*
- *Presence of often disenfranchised cross-border indigenous groups*
- *General unavailability of maritime support.*
- *Lack of transportation infrastructure.*
- *Vulnerability of sustainment lines.*
- *Extended periods of darkness or daylight.*
- *Elevated attrition rates and inefficiency.*
- *Experienced, trained, equipped, and well-positioned adversaries.*

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